

## **Section 3.7**

### **Implicit Differentiation**

$$y = x^2 \quad \text{EXPLICIT}$$

$$xy + y^2 = 5 \quad \text{IMPLICIT - "Hidden"}$$

**y is a function of x**

## **Example**

**Differentiate**

$$y^2 = x$$

**Differentiate both sides with  
respect to  $x$**

**Then solve for  $\frac{dy}{dx}$**

$$\mathbf{x^3 + y^3 - 9xy = 0}$$

$$\cos^2 y - \sqrt{x^3 + 1} = 5 + x$$

**Page 162, numbers 1-8 ALL**

**Find  $\frac{d^2y}{dx^2}$  if  $2x^3 - 3y^2 = 8$**

**Find the second derivative of  $x + y^2 = 4$**

**Find the slope of the circle  $x^2 + y^2 = 25$  at the point  $(3, -4)$**



**Write the equation of the line tangent to  
 $x^2 + y^2 = 25$  at  $(3, -4)$**

**Find the tangent and normal to the ellipse  
 $x^2 - xy + y^2 = 7$  at the point  $(-1, 2)$ .**

**At what point(s) is the tangent to**

$$3y + 2(3) - y = 0 \quad 2y + 6 = 0$$

**$xy + 2x - y = 0$  parallel to  $y = 1/2 x + 2$ ?**

$$1(y) + x\left(\frac{dy}{dx}\right) + 2 - \frac{dy}{dx} = 0 \quad m = \frac{1}{2}$$

$$y + x \frac{dy}{dx} + 2 - \frac{dy}{dx} = 0$$

$$\frac{dy}{dx}(x - 1) = -y - 2$$

$$\frac{dy}{dx} = \frac{-y - 2}{x - 1}$$

**At what point(s) is the tangent to  $y = 2e^{2x}$  parallel to  $-x + y = 2$ ?**

$$y' = 2e^{2x} \cdot 2$$

$$y' = 4e^{2x}$$

$$-x + y = 2$$

$$y = x + 2$$

$$m = 1$$

$$4e^{2x} = 1$$

$$e^{2x} = \frac{1}{4}$$

$$\ln e^{2x} = \ln \frac{1}{4}$$

$$2x = \ln \frac{1}{4}$$

**The position of a particle is  $s(t) = 2 \sin 3t$ .**

**At what times in  $[0, 2\pi]$  is the particle moving upward?**



